



REPAIR OF WATER GATES AND LOW POINTS IN PREY NOB SEA DEFENCE

Investment ID: 3.6

INTRODUCTION



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|---------------|--|
| Deliverables | <ul style="list-style-type: none"> • Repairing water gates • Identifying low points in existing flood embankment • Repairing and raising low points in flood embankment |
| Beneficiaries | 20,000 |
| Budget | US\$ 97,750 |
| Location | Protects Ou Oknha Heng, Prey Nob, Ou Chou and Veal Rinh communes |

Problem Statement

The communities of Prey Nob district lying on the west side of the Kampong Smach estuary have been protected from sea flooding since 2001 by an earth embankment and roadway separating the paddy fields from the mangrove forest. On the landward side of the embankment is a 30m wide flood drainage canal for conveying fresh water floods in the rainy season and this empties under the embankment through a series of 36 manually-operated vertical sluice gates. Repairs are required to several of the sluice gates. There are also locations where the current flood embankment is being overtopped in severe storms, approximately once every 2-3 years, and there is a need to identify low points as a preliminary measure to any future project to raise and improve the embankment. Raising the entire embankment would incur costs above the current project budget but identifying low points will enable some targeted repairs improving the functionality of the existing flood embankment, will have immediate benefits and are within the scope of the project's available budget.

Location

The existing flood embankment extends from the main road in Ou Oknha Heng Commune towards the sea and then turns north-east and continues between the existing mangrove and paddy fields to join National Road 3 just west of the bridge over Kampong Smach River. The area where the existing vertical sluice gates are reported to be not working correctly is near the southern corner (indicated on the map below), where two sets of gates are not functioning.

Beneficiaries

The existing sea defence protects houses and approximately 2,000 ha of paddy fields in the communes of Ou Oknha Heng, Prey Nob and Veal Rinh. The commune of Ou Chrou is also affected. In these communes there are 27,667 residents listed and it is understood that due to the low-lying nature of the coastal strip here a significant majority are directly affected by sea flooding and the entire community is affected by crop loss as a result of the flooding. Failure of the sluice gates in the open position will allow salt water ingress which will damage crops, and failure in the closed position will lead to fresh water flooding of the paddy fields during the rainy season as floodwaters would be restricted from egress to the sea. Identification and repair of the low points in the embankment will also reduce instances of salt water ingress.

Approximately 20,000 people are included as benefitting directly from this scheme.

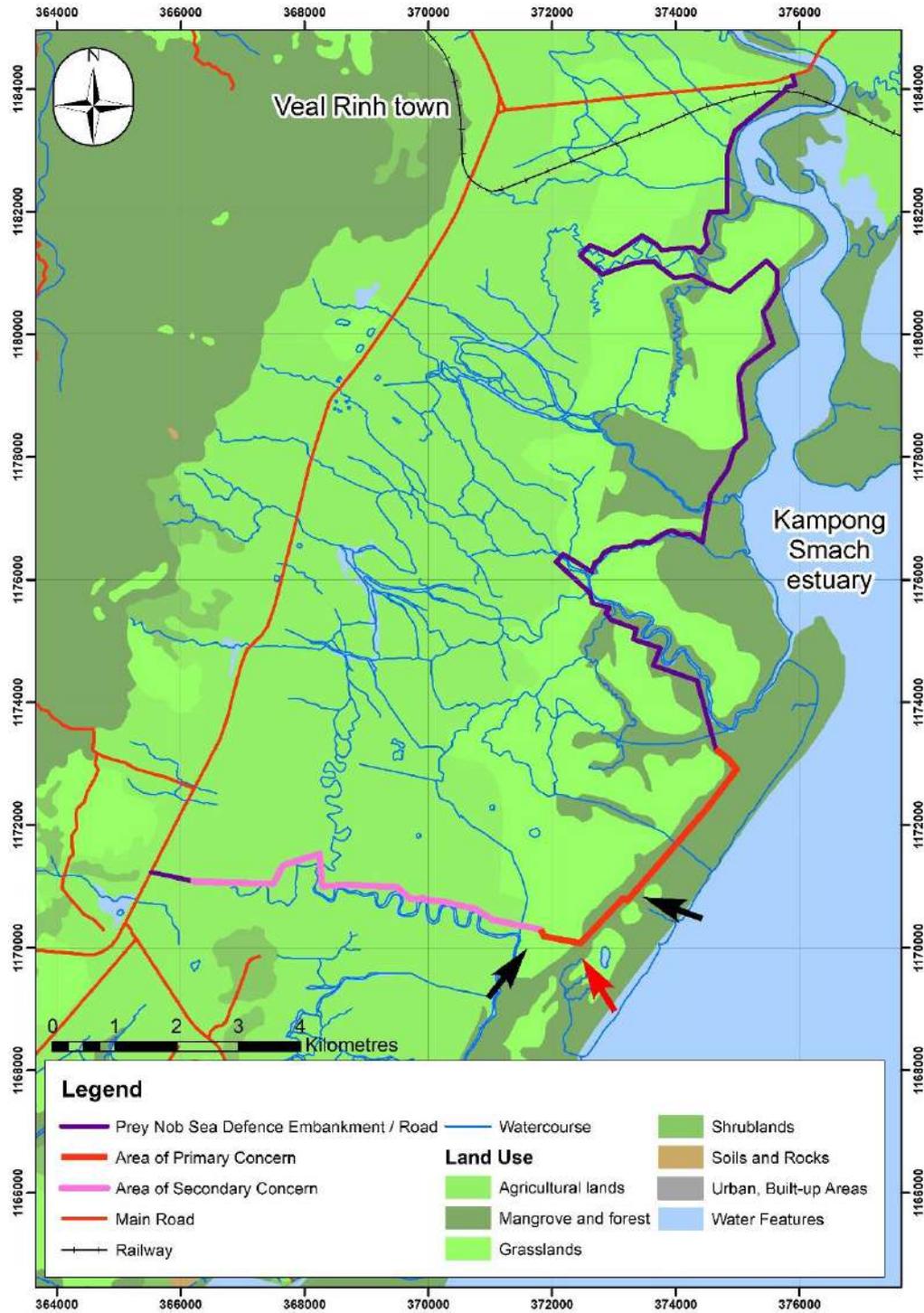


Figure 1 Prey Nob sea defence embankment. The black arrows indicate locations of sluice gates requiring refurbishment and the red arrow indicates location of a gate requiring a new ladder. The areas indicated as of primary and secondary concern are those sections of the existing embankment where low points are being overtopped.

BUDGET

Refurbishment of two water gates not currently working and replacement of ladder

| DESCRIPTION | QUANTITY | UNIT PRICE | COST |
|---|--------------|--------------|------------------|
| Provision of stop boards to enable access (approx..2.5m x 1m, 2 per gate) | | | \$ 500 |
| New steel gates and mechanism and refurbish runners | 4 sets | \$ 5,000 | \$ 20,000 |
| Remove rusted rungs and install new steel ladder access | 10 locations | | \$ 5,000 |
| Labour – skilled (1 team leader for 10 days) | 10 | \$ 30 | \$ 300 |
| Labour – unskilled (5 operatives for up to 10 days each) | 46.5 | \$ 15 | \$ 700 |
| | | Total | \$ 26,500 |

Topographic Survey, Boreholes and infilling of low points in the flood embankment

| DESCRIPTION | QUANTITY | UNIT PRICE | COST |
|---|---------------------|--------------------|------------------|
| Topographic survey along crest of embankment, 5 km – (2 x skilled surveyor for 160 man hours each) | 320 | \$ 25 | \$ 8,000 |
| Geotechnical survey – 10m deep boreholes at 12 locations along the embankment to test ground conditions, including field engineer | 120m | \$ 120 | \$ 14,400 |
| Ground investigation – analysis of samples from boreholes | | | \$ 7,200 |
| Fill material to repair low points in the embankment | 6,000m ³ | \$ From O Thmar | \$ 0 |
| Transportation of fill material from O Thmar | 473 trucks | \$ 50 | \$ 23,650 |
| Labour – skilled (1 team leader for 120 days) | 120 | \$ 30 | \$ 3,600 |
| Labour – unskilled (8 labourers for 120 man hours each) | 960 | \$ 15 | \$ 14,400 |
| | | Grand total | \$ 97,750 |

DATA COLLECTION

Inputs

This study has been informed by data provided by the Ministry of the Environment, Preah Sihanouk Provincial Department of Water Resources and Meteorology, Preah Sihanouk Provincial Department of the Environment and the leaders of Boeng Taprom, Ou Oknha Heng, Prey Nob, Ou Crou and Veal Rinh Communes. Costings data has been provided with reference to various online resources including the Ministry of Public Works and Transport contract for the upgrading of National Road no 3 (dated 2012), adjusted for inflation. Mapping has used Google Earth satellite imagery and openly available GIS data including geology, land use and watercourses.

Consultations

Consultation has been carried out with the national Ministry of the Environment, Preah Sihanouk Provincial Department of Water Resources and Meteorology, Preah Sihanouk Provincial Department of the Environment and the leaders of Boeng Taprom, Ou Oknha Heng, Prey Nob, Ou Chrou and Veal Rinh Communes.

For further information on the consultations undertaken in the formulation of the proposal, please refer to Part II, Section H.

Site Records

A site visit took place, where several of the sluice gates were inspected and the entire embankment was traversed by vehicle. There are areas of informal settlement buildings along the sides of the embankment, mostly on the seaward (mangrove) side, although there were several instances of buildings on the opposite side of the flood drainage canal, accessed via boat or makeshift bridges. If the embankment does require significant raising in future it is likely the bulk of the work will need to be done on the mangrove side in order to retain maximum flow capacity in the drainage canal, although we were advised that the canal is very shallow and it might be possible to increase capacity by deepening the channel if needed.

The sluice gate structures are all of approximately the same age and the same design. The rusted-through rungs were only observed on one gate but not all the gates were inspected in detail. Consultation with the Department of Water Resources and Meteorology indicated this issue applied to a further 9 gates, so funding has been requested to replace 10 ladders.

IMPLEMENTATION

Design

The design comprises five elements, grouped into two sub-headings. These are:

Repair of gates

- **Repair of the existing sluice gates.** Works to involve placing stop boards in the slots provided (Photo 1 in the Photos section below) to allow safe access and prevent water flow through while the gates are dismantled. The actions are then as follows:
 - a. Remove existing gates and either refurbish or replace the gates with new steelwork to the same design.
 - b. Refurbish the gate mechanism and the vertical runners.
 - c. Reassemble the gates.
- **Replace ladder.** Activities required:
 - d. Measure the height of the ladder required.
 - e. Cut away the existing steel rungs which are corroding (Photo 2 in the Photos section below).
 - f. Install new off-the-shelf stainless steel ladder of suitable length with a minimum of three brackets pre-welded to it (top, middle and bottom) and secure this into the concrete uprights using resin anchor bolts at a minimum of six locations (either side of ladder at top, centre and bottom, two bolts to each bracket).

Embankment Repair

- **Undertake topographic survey.** This should be carried out along the centre of the flood embankment along the entire 34.5km length.
- **Geotechnical survey.** Boreholes should be driven to 10m depth (or first refusal) at approximately 500m intervals along the section of the embankment marked in the map above as 'Area of Primary Concern', and should be located as close to existing sluice gates where an open channel through the mangrove exists as possible. This is because these areas are likely to be where historic deeper channels existed and so the ground may be less stable here.
- **Infill low points in embankment.** The topographic survey is necessary to identify the lowest points where overtopping is occurring. Once the survey has identified these points, bring in hardcore as necessary to raise the embankment structure. Mix in clay with the hardcore to improve the cohesion of the structure. It is anticipated that up to 0.5m depth of fill will be required in some locations. Along with the topographic survey results liaise with the Preah Sihanouk Department of Water Resources and Meteorology to ensure that all areas of overtopping are addressed. There is a possibility that areas close to open channels through the mangrove may be subject to higher incidences of overtopping as there is more risk of wave run-up and 'funneling' of water through the open channels than where mangrove provides further protection. The estimate assumes sufficient material to raise a 3km length of embankment 4m wide by 0.5m high.

The Report of Shoreline Assessment (2014) carried out for the Cambodia Ministry of the Environment suggests that maximum sea water level is expected to rise by 0.8m in the Prey Nob area by 2100. Given that the embankment is already overtopping in places to 0.5m, it will therefore have to be raised by a minimum of 1.3m to provide protection against frequent flood events up to 2100. This is not possible within the budget of the existing project, but in undertaking the topographic survey we will have identified the areas most in need of raising so this work can also be targeted more efficiently in future projects.

Community Engagement

The affected communities have been consulted on several occasions and we have additionally consulted with all the communes in Prey Nob district. The works required have been proposed by the communities themselves and there are no indications that the works would adversely impact anyone. The works should proceed with the full engagement of the community, using local labour and materials where possible, and minimising disruption to the adjacent farming and fishing communities.

For further information on the consultative process, please see Part II, Section H of the proposal.

Construction

The access road along the embankment is a single-track road with very few passing places. Any construction machinery required should be kept to small sized vehicles where possible and care should be taken to avoid the machinery causing damage to the embankment.

Contractor Requirements

The full topographic survey must be taken along the line of the embankment before any raising works are commenced, to ensure the repairs are correctly targeted to the lowest-lying areas. The borehole data will inform areas of deeper mud channels which could potentially sink more readily. If there is evidence of excessive settlement in these areas it is recommended that the embankment in these areas is raised by 0.5m above the neighbouring sections to provide for future settlement in the same area.

Upon completion of construction the crest level should be resurveyed throughout to ensure a consistent flood defence level.

Key Risks & Safeguarding Issues

§ Environmental

The works will require heavy components and machinery to be brought to site, and the existing road access along the top of the embankment is both narrow and unsurfaced. Care should be taken to avoid damage to the embankment and sluice gate structures from any machinery or vehicles, including the risk of vehicles and machinery falling off the embankment into the water.

The works will require some import of fill material to raise the embankment at identified low points. All material brought to site should be screened to ensure that no invasive species are imported accidentally.

§ Social Safeguards

There is a risk of conflict between the workforce employed on the construction and the local community. Care should be taken to minimise this risk. The community have been proactive in requesting the work to be done and where possible a local workforce should be employed. In the longer term, when the embankment requires more significant work to raise and widen its footprint this may impact the informal settlement communities on the seaward side. However, work under this investment should not cause this problem.

§ Gender/Youth (if applicable)

No safeguarding issues identified

For more information about the project's approach to environmental and social safeguards, please see Part II, Section K.

TECHNICAL DRAWINGS

For gate repairs please refer to existing design drawings for the sluice gate fittings and sizes.

The ladder should be a standard commercially available ladder of the correct size. Refer to the existing design drawings and measure the height required on the existing sluice gates.

PHOTOS

Figure 2 *“Photo 1 – Existing sluice gate. Note the stop board slots on the outside of the structure (arrowed). When boards are placed in these down to the cill this will enable the gates to be removed and refurbished while water is prevented from passing through the structure”*





Figure 3 *“Photo 2 – note the steel rungs projecting from the near upright of the sluice gate structure. Some of these were observed to have rusted through. A new steel ladder should be provided fixed securely into the concrete uprights using brackets.”*



Figure 4 *“Photo 3 – The existing shallow embankment showing the limited width for vehicle access and the drainage canal to the left (landward) side. Informal settlement building on the right-hand side.”*

Table 1

| ENVIRONMENTAL AND SOCIAL SAFEGUARD PRINCIPLE | RISK MITIGATION ACTIONS INCORPORATED IN THE DESIGN |
|---|--|
| <p><i>Compliance with the law</i></p> <p>projects/programmes supported by the Fund shall be in compliance with all applicable domestic and international law.</p> | <p>The entire length of the embankment is classified as state public land and can be accessed by a public road (indeed, it is a public road). All actions concerning the repair of the embankment have been checked and are compliant with relevant national laws, as detailed in the proposal Part II, Section E.</p> |
| <p><i>Access and Equity</i></p> <p>Projects/programmes supported by the Fund shall provide fair and equitable access to benefits in a manner that is inclusive and does not impede access to basic health services, clean water and sanitation, energy, education, housing, safe and decent working conditions, and land rights. Projects/programmes should not exacerbate existing inequities, particularly with respect to marginalized or vulnerable groups.</p> | <p>The investment will deliver reduced instances of salt water ingress into agricultural land, improving the likelihood of high crop yields and protecting the income and food supply for a significant number of people in the Prey Nob district. The agricultural and fishing communities living in the informal areas of settlement will experience improved access and improved food security.</p> <p>There will be some localised short-term disruption to traffic along the road accessing the informal settlements while work is taking place on the embankment.</p> <p>The investment will not discriminate in the services it provides to the target beneficiaries.</p> |
| <p><i>Marginalised and Vulnerable Groups</i></p> <p>Projects/programmes supported by the Fund shall avoid imposing any disproportionate adverse impacts on marginalized and vulnerable groups including children, women and girls, the elderly, indigenous people, tribal groups, displaced people, refugees, people living with disabilities, and people living with HIV/AIDS. In screening any proposed project/programme, the implementing entities shall assess and consider particular impacts on marginalized and vulnerable groups.</p> | <p>There are no anticipated issues regarding marginalised groups. There is some old data to suggest that small number of undocumented ethnic Vietnamese live in Prey Nob District but this was cross-checked with the elected Commune Council representatives and provincial level officials, who both assert that all undocumented ethnic Vietnamese have now been formalized and given Cambodian identity papers.</p> |

Human Rights

Projects/programmes supported by the Fund shall respect and where applicable promote international human rights.

There is no evidence to suggest that human rights will be violated. Rights issues concerning land, women, labour and indigenous people are addressed separately in this sheet.

Gender Equity and Women’s Empowerment

Projects/programmes supported by the Fund shall be designed and implemented in such a way that both women and men 1) have equal opportunities to participate as per the Fund gender policy; 2) receive comparable social and economic benefits; and 3) do not suffer disproportionate adverse effects during the development process.

In the poor communities affected by the proposal it was observed that women tend to take more of a household and community management role and therefore they are likely to benefit further from the community’s improved crop yield, as they will be likely to take on the role of selling surplus crops. If the road overtops less frequently there will also be improved access to the market in Veal Rinh (see investment 3.7). Livelihoods derived from the market tend to have greater benefits for women.

Men and women will be given equal opportunity to provide their labour to the construction process, under the [People’s Process](#) approach. Whenever women provide their labour, the project will ensure that they have access to separate bathrooms and hygienic products.

All labourers (male and female) employed under the project will be given a mandatory briefing on the prevention of sexual harassment and exploitation prior to commencing their work.

Core Labour Rights

Projects/programmes supported by the Fund shall meet the core labour standards as identified by the International Labour Organization.

There are no specific risks to core labour rights resulting from this investment. However, the following safeguard provisions will be made.

Safety equipment will be required for workers on the site and provided for them.

This activity will draw upon unskilled labour from the community. All workers in the project will be informed of their rights to organise, including joining formal labour unions, in accordance with the law. Unskilled labourers will be paid \$300 per month (assuming an 8-hour working day, 5 days per week, this is 50% higher than the national minimum wage).

| | |
|--|---|
| | <p>All workers employed by the project (including under agreement of cooperation) will be aged 18 or over)</p> |
| <p>Indigenous People</p> <p>The Fund shall not support projects/programmes that are inconsistent with the rights and responsibilities set forth in the UN Declaration on the Rights of Indigenous Peoples and other applicable international instruments relating to indigenous peoples.</p> | <p>There is no evidence of indigenous people or undocumented migrants in the target area, and consequently there is no risk that the activities will affect indigenous people. Please also see explanation provided above in marginalised and vulnerable groups.</p> |
| <p>Involuntary Resettlement</p> <p>Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids or minimizes the need for involuntary resettlement. When limited involuntary resettlement is unavoidable, due process should be observed so that displaced persons shall be informed of their rights, consulted on their options, and offered technically, economically, and socially feasible resettlement alternatives or fair and adequate compensation.</p> | <p>The works all involve work on public state-owned land and are accessed by public roads.</p> <p>There are some small informal settlement communities on the sea-ward side of the embankment. These communities will not be resettled as a consequence of the work, and the work can proceed as planned with these people in situ.</p> |
| <p>Protection of Natural Habitat</p> <p>The Fund shall not support projects/programmes that would involve unjustified conversion or degradation of critical natural habitats, including those that are (a) legally protected; (b) officially proposed for protection; (c) recognized by authoritative sources for their high conservation value, including as critical habitat; or (d) recognized as protected by traditional or indigenous local communities.</p> | <p>The investment will help to maintain the boundary between salt water mangrove and cultivated paddy fields. As such it will help to prevent further erosion of the mangrove forest, by maintaining a clear delineation between the mangrove and cultivated land. There are areas of mangrove to seaward of the existing flood defence embankment that appear to have been previously cleared for cultivation but are now returning to nature. A separate investment will address re-planting these areas.</p> |

Conservation of Biological Diversity

Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids any significant or unjustified reduction or loss of biological diversity or the introduction of known invasive species.

Material imported to repair and consolidate the embankment should be environmentally screened to ensure that there are no invasive species brought to site.

While there is substantial biodiversity in the area, including numerous fish species and birds, they will not be affected by the construction works taking place in a small section of the existing embankment and road.

Climate Change

Projects/programmes supported by the Fund shall not result in any significant or unjustified increase in greenhouse gas emissions or other drivers of climate change.

This investment will help to offset the effects of climate change for the poor local communities. There will be necessary but controlled CO2 emissions associated with the construction period only.

Pollution Prevention and Resource Efficiency

Projects/programmes supported by the Fund shall be designed and implemented in a way that meets applicable international standards for maximizing energy efficiency and minimizing material resource use, the production of wastes, and the release of pollutants.

Environmental safeguards should be applied during the construction works to ensure no cement or oils are allowed into the environment. The works will reduce the instances of pollution by improving performance of the existing embankment and water gates to better control flood flows.

The fill material for the embankment to be sourced from the investment at O Thmar reservoir

Public Health

Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids potentially significant negative impacts on public health.

This investment should benefit public health by improving crop production.

The construction will not use any hazardous materials or chemicals that could damage public health.

Physical and Cultural Heritage

Projects/programmes supported by the Fund shall be designed and implemented in a way that avoids the alteration, damage, or removal of any physical cultural resources, cultural sites, and sites with unique natural values recognized as such at the community, national or international level. Projects/programmes should also not permanently interfere with existing access and use of such physical and cultural resources.

The investment activities will not harm physical or cultural heritage. There are no sites of cultural, spiritual or religious heritage in or around the embankment or surrounding waterways.

Land and Soil Conservation

Projects/programmes supported by the Fund shall be designed and implemented in a way that promotes soil conservation and avoids degradation or conversion of productive lands or land that provides valuable ecosystem services.

This investment should reduce the instances of salinisation and soil degradation by preventing upstream salt water ingress. This will improve the quality of the agricultural soil.

See pollution prevention and resource efficiency concerning the embankment fill material